23. tan, $\perp$ $2xy + \pi \sin y = 2\pi$ $\left(1, \frac{\pi}{2}\right)$

$$2xy' + y \cdot 2 + \pi y' \cdot \cos y = 0$$

$$2xy' + \pi \cos y \cdot y' = -2y$$

$$y'(2x + \pi \cos y) = -2y$$

$$y' = \frac{-2y}{2x + \pi \cos y}\Bigg|_{\left(1, \frac{\pi}{2}\right)} = \frac{-\pi}{2 + \pi \cdot 0} = \frac{-\pi}{2}$$

tan line $y = -\frac{\pi}{2}(x-1) + \frac{\pi}{2}$

$\perp$ line $y = \frac{2}{\pi}(x-1) + \frac{\pi}{2}$

Oct 3-9:17 AM

30. $y^2 + 2y = 2x + 1$ $\frac{dy}{dx}$, $\frac{d^2y}{dx^2}$

$y' \cdot 2y + 2y' = 2$ y', y''

$y'(2y+2) = 2$ $\dot{y}$, $\ddot{y}$

$$y' = \frac{2}{2y+2} = \frac{2}{2(y+1)}$$

$$y' = \frac{1}{y+1}$$

$$y'' = \frac{(y+1)0 - 1 \cdot y'}{(y+1)^2} = \frac{-y'}{(y+1)^2}$$

$$y'' = \frac{-\frac{1}{y+1}}{(y+1)^2} = \frac{-1}{(y+1)^3}$$

Oct 3-9:25 AM

27 $x^2+y^2=1$

$2x + y'\cdot 2y = 0$

$y' = \frac{-2x}{2y} = \frac{-x}{y}$

$y'' = \frac{y\cdot(-1) - (-x)y'}{y^2}$

Oct 3-9:32 AM

3.7b Implicit Differentation

Show that dy/dx is defined at every point on the graph of $2y = x^2 + \sin(y)$

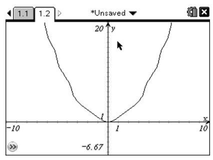
$2y' = 2x + y'\cos y$

$2y' - y'\cos y = 2x$

$y'(2-\cos y) = 2x$

$y' = \frac{2x}{2-\cos y}$

y' defined everywhere because $2-\cos y \neq 0$ since max of $\cos y$ is 1



Graph the curve using parametric equations

solve for x: $x = \pm\sqrt{2y-\sin y}$

$x_1 = \sqrt{2t-\sin t}$

$y_1 = t$

$x_2 = -\sqrt{2t-\sin t}$

$y_2 = t$

Sep 29-7:40 AM

$x^2 - 2xy + y^2 = 4$

1. Find dy/dx

$2x - (2x \cdot y' + y \cdot 2) + 2y \cdot y' = 0$

$2x - 2xy' - 2y + 2yy' = 0$

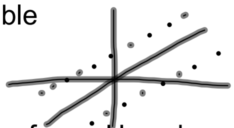
$-2xy' + 2yy' = -2x + 2y$

$y'(-2x+2y) = -2x+2y$

$y' = \frac{-2x+2y}{-2x+2y}$

$y' = 1$

2. Use dy/dx to sketch a possible graph of the implicit curve.



3. Factor the left side and solve for y. How does this compare with your graph?

$(x-y)(x-y) = 4$

$(x-y)^2 = 4$

$x - y = \pm 2$

$y = x+2$ or $y = x-2$

Sep 29-8:00 AM

Prove the power rule for rational exponents

Sep 29-8:12 AM

Find the slope of the Folium of Descartes at the points (4,2) and (2,4).

$x^3 + y^3 - 9xy = 0$

$3x^2 + 3y^2y' - (9x\cdot y' + y\cdot 9) = 0$

$3x^2 + 3y^2y' - 9xy' - 9y = 0$

$3y^2y' - 9xy' = -3x^2 + 9y$

$y'(3y^2 - 9x) = -3x^2 + 9y$

$y' = \frac{-3x^2+9y}{3y^2-9x} = \frac{-x^2+3y}{y^2-3x}$

$y'(4,2) = \frac{-3\cdot 4^2 - 9\cdot 2}{3\cdot 2^2 - 9\cdot 4} = \frac{5}{4}$

$y'(2,4) = \frac{4}{5}$

Find the points where the folium has: (a) a horizontal tangent; (b) a vertical tangent

derivative = 0

$\frac{-x^2+3y}{y^2-3x} = 0$

$-x^2 + 3y = 0$

$x^3 + y^3 - 9xy = 0$